Claim 1 concerns a method for determining a dynamic range of a digital medical image for a medical imaging system, wherein the digital medical image contains a clinical region. The method includes dividing a digital medical image into at least two bands of predetermined width, determining whether the digital medical image within the at least two bands includes at least one non-clinical region, and calculating a dynamic range based on a clinical region within each of the at least two bands.

It is respectfully submitted that Ergun does not teach or suggest, among other things, the step of dividing a digital medical image into at least two bands of predetermined width. The Office Action refers to FIG. 19 of Ergun as an example of teaching the dividing step. However, FIG. 19 of Ergun illustrates two types of distortion, isotropic and anisotropic. (Col. 9, lines 25-26) FIG. 19 illustrates correcting the distortion "by imaging the known grid 100 and comparing the distorted image of the grid 100 to the known grid 100 to deduce the degrees of distortion." (Col. 9, lines 58-60) Therefore, Ergun does not teach or suggest dividing a digital medical image into at least two bands of predetermined width in FIG. 19, nor is it suggested anywhere else in Ergun.

As to calculating a dynamic range based on a clinical region within each of the at least two bands, the Office Action refers to the brief description of FIG. 12 of the Ergun patent, which "is a plot of raw image data from the image intensifier/video camera as is translated into pixel brightness in the images of FIGS. 7, 8, 10, and 11 by the microprocessor of FIG. 6 according to a non-linear mapping process such as provides noise equilibrium in the images and maximum dynamic range for clinical data." (Col. 4, lines 40-45) FIG. 12 of Ergun illustrates two bands which are "equally wide bands of image pixel brightness 104 and 106" (Col. 10, lines 57-58) that clearly do not include the entire digital medical image.

Turning to FIGS. 6-11 of Ergun as referred to above, FIGS. 6-11 concern the correction of motion from one image frame to the next. FIGS. 7 and 8 illustrate a stationary object 90 and a moving object 92. (Col. 8, lines 1-3) FIG. 9 illustrates the method of comparing the pixels 88, 88" (step 94) and assigning a weight to each pixel 88, 88" based on the amount of change between one pixel 88, 88" in FIG. 7 and its corresponding pixel 88 and 88" in FIG. 8. A greater change

indicates motion, such as pixel 88" in FIG. 7, which illustrates tissue, and the corresponding pixel 88" in FIG 8, which illustrates a blood vessel or moving object 92. "Accordingly, the present invention develops an average image combining the values of the pixels acquired in each frame 86, 86' in which those pixels in the current image 86' which exhibit very little change between images 86 and 86' contribute equally to the average image, but those pixels in the current image 86' that exhibit a great degree of change between images 86 and 86' are given a substantially greater weight in the average image." (Col. 8, lines 38-47) FIGS. 10 and 11 illustrate a rectilinear grid 100 which appears to have a barrel or pincushion shape caused by distortion and two equal size regions of interest 105 which do not encompass equal areas of the x-ray beam 80. Therefore, FIGS. 6-12 and the corresponding text of Ergun, or elsewhere else in the patent to Ergun, do not teach or suggest the steps of dividing a digital medical image into at least two bands of predetermined width, and calculating a dynamic range based on a clinical region within each of the two bands. Therefore, claim 1 is not anticipated, nor rendered obvious, by Ergun, and thus should be allowable.

Independent claim 11 concerns a medical diagnostic imaging system for controlling a dynamic range of a digital medical image to be displayed. The system includes a segmentation module identifying clinical and non-clinical regions within a digital medical image, wherein the non-clinical regions comprise at least a collimated region. The system further includes a dynamic range module determining a dynamic range of a clinical region of the digital medical image based on the clinical region.

It is respectfully submitted that Ergun does not teach or suggest a segmentation module identifying clinical and non-clinical regions wherein the non-clinical region includes a collimated region. The scatter map of Ergun referred to in the Office Action is used to process an image with the purpose of reducing scattered x-rays 212 that do not carry information about the attenuated tissue. X-rays may be scattered by the soft tissue 204 and proceed at an angle to the portion 210 of the attenuation image 208 beneath the spine 200. Because the scattered x-rays 212 do not carry information about the attenuation of the spine 200, they are desirably removed from the image

208 prior to its use in quantitative measurement. (Col. 15, lines 55-64). FIGS. 21 and 23 of Ergun illustrate a spine 200 surrounded by soft tissue 204. An occluder 214 is placed between the x-ray generator and the patient. The occluder 214 includes lead pins 216 at known locations which are "sized so as to substantially block all direct x-rays from passing through them but so that their images 218 include a significant portion of scattered x-rays 212. (Col. 16, lines 6-9, emphasis added) At each pin image 218, a value 222 measures the scatter received in the vicinity of the image 218 caused generally by the effect of the soft tissue 204 and possible secondary scatter effects in the image intensifier 206. From value 222, a set of normalizing points may be established for the purpose of adjusting the scatter map 234 either upwards or downwards to eliminate or reduce the scatter in that image. The scatter map is then subtracted from the image at block 239 of FIG. 22. Therefore, Ergun's system does not detect or identify a collimated region within a non-clinical region, then determine a dynamic range of a clinical region based on the clinical region. Thus, claim 11 is not anticipated, nor rendered obvious, by Ergun, and should be allowable.

Turning to the dependent claims, claim 3 concerns dividing the digital medical image into one of horizontal and vertical bands. Claim 27 concerns a processor dividing the digital medical image into at least two bands comprising one of horizontal and vertical bands, and further includes the dynamic range module determining a dynamic range of the clinical region within the at least two bands. As stated previously, Ergun does not teach or suggest dividing the digital medical image into horizontal or vertical bands at column 11, lines 13-32, FIG. 19, nor is it suggested elsewhere in Ergun.

Claim 9 concerns generating a histogram of the digital medical image and masking gray scale levels from the histogram that exceed predetermined upper and lower thresholds. Claim 19 depends from claim 11 and includes a processor within the dynamic range module masking over the non-clinical regions when determining the dynamic range of the clinical region. Ergun does not mask gray scale levels that exceed a lower threshold based on any data, including data indicative of a collimated region. Ergun also does not mask over the non-clinical regions wherein

the non-clinical regions comprise at least a collimated region, as in claim 11. Instead, Ergun states "the present invention identifies one peak 124 in histogram 122 as background pixels indicated by process block 120 in FIG. 14. In identifying this peak 124, the computer 22 examines the histogram 122 from the brightest pixels (rightmost) to the darkest pixels (leftmost) assuming that the brightest pixels are more likely to be the unattenuated background pixels." (Col. 11, lines 4-51, emphasis added) Therefore, when the peak 124 is identified, "the pixels associated with that peak are removed per process block 126 by thresholding or subtraction." (Col. 11, lines 54-56) Therefore, Ergun's system does not look for or mask non-clinical regions comprising a collimated region.

Claim 15 depends from claim 11 and further includes the segmentation module identifying the non-clinical regions based on variations in gray scale levels of the digital medical image. Claim 17 depends from claim 11 and further includes the segmentation module discriminating the non-clinical region based on at least one gray scale threshold value. Claim 18, depending from claim 11, further comprises a processor calculating at least one threshold based on a dynamic range of the digital medical image, the segmentation module discriminating the non-clinical region based on the threshold. It is respectfully submitted that Ergun's system does not provide the method or apparatus for discriminating a non-clinical region comprising at least a collimated region. Ergun's system only detects unattenuated pixels, and is incapable of detecting collimated pixels at unknown locations, as discussed previously in relation to claims 9, 11 and 19.

Claim 22 depends from claim 11 and further comprises a processor generating a histogram of at least a portion of the digital medical image to identify gray scale levels associated with the non-clinical regions. Claim 23 depends from claim 11 and further includes the segmentation module masking the non-clinical regions identified in the digital medical image. Claim 24 depends from claim 11 and further includes the segmentation module determining that the digital medical image does not include the non-clinical regions, and uses the digital medical image to determine the dynamic range of the digital medical image. As discussed previously, Ergun's system does not provide the ability to identify a collimated region included in a non-clinical

region. Therefore, the non-clinical regions referred to by claims 22-24 are not anticipated or rendered obvious by Ergun's system.

It is respectfully submitted that the pending claims define allowable subject matter. Should anything remain in order to place the present application in condition for allowance, the Examiner is kindly invited to contact the undersigned at the telephone number listed below.

Please charge any additional fees or credit overpayment to the Deposit Account of McAndrews, Held & Malloy, Ltd., Account No. 13-0017.

Respectfully submitted,

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Date: August 13, 2002

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